

# FUSIONNEWS

# 29K

A quarterly AMD® publication  
for 29K™ Family customers  
and Fusion29K™ partners  
**Issue 3 • Summer 1990**

## ***First to use RISC processor***

# Samsung shows 29K-based X Terminal

Through its Andover, Mass.-based Samsung Software America subsidiary, Samsung Electronics Company of Seoul, South Korea recently announced its first X terminal, the Am29000™ micro-processor-based SGS -19. The SGS -19 is the industry's first RISC-based X Terminal. The Samsung terminal uses a 16-MHz Am29000 processor to provide substantial speed advantages over other X Terminals, including comparably priced machines and costlier devices occupying the high-end of the X Terminal market. The terminal features a 19" monochrome monitor with 1280 x 1024

display resolution, Ethernet and serial communications, and 2 Mb of on-board RAM expandable to 18 Mb.

### **Am29000 processor meets Samsung's requirements**

"We evaluated a number of processors for our first X-Terminal," said Alex Valentine, Manager, Product Planning and Market Development for Samsung Software America. "We picked the 29K because it provides the best balance—high performance not only for the graphics code but also the general purpose code needed for the X server implementation. In

addition, the 29K's memory interface allowed us to use a DRAM only memory architecture. In an X Terminal, the monitor and memory are the two biggest expenses. Samsung makes both! Because of Samsung's vertical integration and the 29K's DRAM interface, we are able to suggest that our OEMs offer this X Terminal for under \$3,000. This makes our SGS-19 the best price-performance terminal on the market."

### **AMD and Partners provide the X Solution**

AMD provides complete application solutions for the X Window marketplace. Companies will offer a wide range of X terminal price/performance points based on Am29000 pin & software compatible architecture. Time to market support is offered by Advanced Graphics Engineering (AGE), who supplied its Xoftware 29K X Windows port for the SGS - 19. AMD's World Network™ offering provides Ethernet solutions with its LANCE and ILACC™ products. OEM inquiries should be directed to Samsung at 508-685-7200.



**A 16-MHz Am29000 processor and DRAM power the fastest X Terminal available.**

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## EB29K board speeds software development

The EB29K™ product is an Am29000-based board that plugs into a IBM-AT or compatible PC. This board uses a 25-MHz processor with separate instruction and data DRAM memories, and demonstrates the high performance available with a low cost memory architecture. The EB29K board is invaluable for application developers who are writing code for the Am29000 processor, or for customers interested in benchmarking the performance advantages of the 29K architecture. The 2 Mb of instruction and data memory allows software developers to work with large programs. Larger applications can be executed on the 4 Mb-version of the EB29K board.

To aid testing and debugging of executable code, a debug monitor also is provided with the EB29K board. The debug monitor will offer a complete range of command line driven debugger options. This monitor software will greatly improve the code debug capability of programmers and reduce devel-



**AMD's EB29K board speeds benchmarking and code compilation.**

opment time.

Compilation time for EB29K software developers will be reduced by 50 percent or more, due to the availability of a native HighC29K™ optimizing compiler. The native compiler package also will include a native assembler, linker and librarian that enhance the software

debug monitor supplied with EB29K board to provide software developers complete source-level to low-level debug capabilities.

For additional information about the EB29K board, please return the enclosed business reply card or call the toll-free 29K Hotline at 800-292-9263.

productivity for your application. This native compiler package will be available in September 1990. See related article on software tools.

XRAY29K support for the EB29K board will be available in September. The XRAY29K source-level debugger will interface with the low-level

## Two 29K Family software tools enhanced

Both the HighC29K and XRAY29K software packages for the Am29000 processor will be updated in September 1990. Enhancements to both packages will improve customers' software productivity and remove the minor bugs associated with earlier versions. All current customers on maintenance will be updated free of charge.

### HighC29K software to run on new hosts

The HighC29K v2.1 package speeds software development by including an optimizing C cross compiler, linker, librarian, and the 29K architectural simulator as well as the following improvements:

- Sun 4 SPARCstation host support (in addition to 386 PC and Sun 3).
- Sun OS 4.0 or greater support.
- Native compiler for the EB29K PC-based execution board.

- Faster linker.
- Improved documentation for the HighC29K and ASM29K products .
- Additional library files for IEEE floating point.
- On-line help manual for UNIX hosts.
- Minor bugs fixes of v2.0.2.

### XRAY29K debugger to support EB29K board

The XRAY29K v1.1 package has been improved by the following enhancements:

- EB29K PC-based execution board support.
- Sun OS 4.0 or greater support.
- Minor bugs fixes of v1.0.

For additional information about HighC29K and XRAY29K packages, please return the enclosed business reply card or call the 29K Hotline at 800-292-9263.



## Hewlett-Packard offers 29K emulator incentive program

Hewlett-Packard Logic Systems Division is offering an incentive program for the HP 64774 Am29000 emulator. Customers making embedded control, computer peripheral, graphics, networking or telecommunications products will be eligible for a \$5,000 (U.S.)

promotional discount. This program will run through September 30. A demo disk describing the features of the HP emulator is available by returning the enclosed business reply card. Interested customers should contact HP's Delano Billingsley at 719-590-5915.

### **Integrated CASE tool set available for 29K Family**

Multiprocessor Toolsmiths of Nepean, Ontario has announced availability of CASEworks/RT to support the 29K™ Family of processors. In fact, CASEworks/RT will support transparently a mixed environment of 29K and Motorola 68K processors.

CASEworks/RT is a complete and integrated software engineering solution for the cross development of multiple processor real-time and/or embedded systems. It covers everything from design concept through integration and testing, and maintenance, an area that system builders are paying closer attention to because of high long-term costs.

Its design analysis and integration features and its system integration features include:

- Support for PC- or VME-based hosts.
- Rapid prototyping support.
- Prototype & final systems design animation.
- Near real-time simulation of target systems.
- Real-time performance verification, analysis.
- Real-time kernel support for pSOS+.
- Automated system building.
- Remote source- and system-level debugging.
- UNIX 4.3BSD compatible services for RTOS.
- Reusable device servers.
- Target portable.
- C language support.

For complete information, please contact Multiprocessor Toolsmiths at 613-727-8707 in Canada.

## Phoenix offers PostScript, PCL 5 on AMD 29K RIP

Phoenix Technologies and AMD have developed the Stallion laser printer controller designs based on the AMD Laser29K™ RIP. The PhoenixPage Stallion provides low-cost, high-performance black and white output starting at an estimated build cost of \$160.

Offering full compatibility with both PostScript and PCL 5, the Stallion is designed to be a turnkey solution for the TEC-6 or TEC-8 marking engines. Basic modifications to hardware and software allow for use with other marking engines.

All Stallion controller designs include the following:

- Standard or customized AMD Laser29K RIP.
- Available in a range of price/performance targets.
- Compatible with future 29K Family components.
- Support future AMD ASIC development.
- Form factor modified to customer's needs.
- Support for multiple communications channels.
- Designed for fast time-to-market.
- The Stallion board will out perform the Apple LaserWriter II NTX. Actual performance will depend on the CPU selected, the clock rate, and the RAM available.

Multiple configurations of the Phoenix Stallion are available to address different price/performance targets. All hardware configurations can contain any of Phoenix's printer emulations including: PCL 4, PCL 5, HPGL, and the PhoenixPage PostScript Interpreter.

For further information, contact Tom Spillane at (617) 551-5030.

## JMI C Executive supports Rev D silicon

JMI Software Consultants has announced that the latest version of JMI's C Executive™ real-time operating system supports Am29000 Rev D silicon. C Executive is a real-time, multi-tasking operating system used in embedded control applications. The operating system allows current CISC users to easily move their applications to the Am29000 RISC processor. Note the following chart of representative C-Executive benchmarks. All times are in microseconds. For more information, call JMI Software Consultants at 215-628-0846.

CPU	68020	Am29000
Board	Force	EB29K
Clock	25 MHz	25 MHz
context switch	17 $\mu$ s	8 $\mu$ s
write system call	29	6
write to queue	91	16
read from queue	87	16



# Apple announces Am29000-based accelerator

## Display card shifts QuickDraw functions to Am29000 processor

Article reprinted from *Microprocessor Report*, March 21, 1990. Copyright © 1990, MicroDesign Resources, Inc., 874 Gravenstein Freeway South, Suite 14, Sebastopol, CA 95472, 707-823-4004.

Apple's long-rumored Am29000-based QuickDraw accelerator has been officially unveiled as the "Macintosh Display Card 8•24 GC." (GC refers to Graphics Coprocessor, and 8•24 refers to the numbers of bits per pixel supported. We'll refer to it simply as the GC.) Prior to its formal announcement, the card was called Monet. The GC, priced at \$1999, includes both a frame buffer and the processor subsystem. Apple also introduced two new frame buffer cards, the 8-bit 4•8 priced at \$648 and the 24-bit 8•24 priced at \$899, which are expected to replace Apple's current products as the mainstream display boards.

All QuickDraw functions, which are normally performed by the 68000-family system processor, are instead performed by the Am29000. (QuickDraw is the set of drawing routines that are part of the Macintosh Toolbox ROM, through which applications access the display.) Apple claims that drawing speed is increased by a factor of 5 to 30 times, depending on the application.

The performance boost provided by the board is especially valuable when using 24-bit color, which is quite sluggish without a display accelerator on even the fastest Macintosh. Apple is pitching the board as providing the performance level of monochrome displays even when running in 24-bit color mode.

Users of 24-bit color image manipulation software are likely to be the most enthusiastic adopters of the new board. Animation programs will be another significant beneficiary. Unfortunately, some PostScript-based drawing programs, such as Aldus Freehand and Adobe Illustrator, will not benefit as much. These programs, for which screen redraw time is often annoyingly slow, usually have their own routines for generating pixels, and use QuickDraw primarily to transfer the pixels to the screen.

The board supports any of Apple's monitors via a single 15-pin connector, and automatically adapts to whatever monitor is connected. For the standard monochrome or color monitors, the resolution is 640 x 480, with up to 8 bits per pixel for monochrome and 24 bits per pixel for color. A resolution of 640 x 870 is provided for Apple's portrait monitor, in addition to 1152 x 870 for their two-page display, both with up to 8 bits per pixel (256 gray levels).

The board also supports standard RS-170 (NTSC) video rates (but not NTSC encoding) for driving television-type interlaced monitors and VCRs at 640 x 480 resolution with up to 8 bits per pixel. A proprietary technique called "Apple Convolution" compares adjacent lines and adjusts the video signal to reduce sharp transitions between them, thus reducing flicker.

### Implications for AMD

The GC board is the highest profile, and potentially highest volume, embedded RISC design win yet announced. As such, it provides a major boost for AMD, in terms of both image and production volume. At some point, Apple is likely to replace the 68020 in their high-end NTX laser printer with a RISC processor. While it may be too much to assume that two different design groups within Apple would make coordinated decisions, the fact that Apple will already be using the Am29000 in one product will presumably not be ignored.

The Am29000 processor in the GC board runs at 30 MHz, near the high end of the Am29000 performance spectrum. The 30-MHz chips are 25-MHz chips that specially screened for Apple, and are not available to other Am29000 customers. The Am29000 is currently in production at 16, 20, and 25 MHz, and is sampling at 33 MHz. The 33-MHz version, which may have been what Apple wanted to use, is fabricated on a more advanced process and is not yet production qualified.

Using the highest available speed grade of a microprocessor (much less one that isn't even on the standard price list) is quite out of character for Apple, which traditionally has been very conservative in pushing clock rates. The use of selected top-speed parts may put AMD in a bind; having your highest volume customer buying your fastest parts is generally undesirable. AMD may need to produce more chips than they can sell in order to get enough chips that meet Apple's speed requirements, which could result in lower prices for the slower versions.

### Hardware and Software Design

Figure 1 shows a block diagram of the GC board. The Am29000's instruction bus is fed by 64 Kbytes of 25-ns static RAM. Two megabytes of video RAM (VRAM) are connected to the Am29000's data bus. This memory is used for the video frame buffer, and also for program memory as a sort of "backing store." The QuickDraw code is too large to fit in the 64 Kbytes

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- B  **29K Family Data Book** with silicon and software datasheets & application notes. 12175A
- C  **Am29000 User's Manual** covering technical details of the Am29000 processor. 10620C
- D  **29K Graphics Primitives Appnote** including diskette with complete listings. 11011A
- E  **FREE demo disk** of the HP 64774A/B 29K Emulator/Analyzer 14487A  
(DSHD 5-1/4" format).
- F  **Intel 80960CA Benchmark Report Critique** brochure. 14178A
- G  Information on upcoming **29K Family seminars**.
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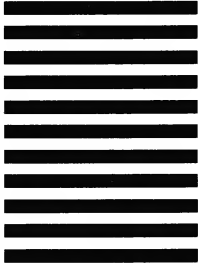


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of SRAM, and Apple's designers didn't want to pay the price or board space penalty of more SRAM or cache control logic.

Instead, they used the Am29000's on-chip MMU to implement a virtual-memory-like system, in which code is paged in from the VRAM to the SRAM when it is needed. The frame buffer controller ASIC implements a pseudo-DMA scheme, in which the Am29000 reads the page of instructions from the VRAM, but does not have to explicitly write them to the SRAM. The ASIC provides the address and write control signals to the SRAM so it can capture the instructions as they appear on the data bus.

The serial access port of the VRAMs provides the video stream. Two SIMM sockets allow 2 Mbytes of DRAM to be added using 1-Mbit chips, or 8 Mbytes using 4-Mbit chips. This DRAM is used for large offscreen graphics and will increase the speed of some applications.

The RAMDAC is a custom device from Brooktree. In addition to providing the traditional color look-up tables and RGB D/A converters, this chip provides support for the Apple Convolution function.

The GC card is the first Apple product to support block-mode transfers on the NuBus. The card can operate as a bus slave or a bus master, and supports block transfers in both modes. When operating as a bus master, it can write screen data to a frame buffer on another video card. This allows the card to accelerate multiple-monitor systems. The fact that the board will accept block transfers as a bus slave seems to imply that future Macintosh computers will provide block mode support on the system board.

The original QuickDraw code was written in 68000 assembly language. To support the GC card, Apple rewrote almost all of QuickDraw in C, and then

compiled it for the Am29000. The end result is almost 200 Kbytes of object code. Only small portions of the code are written in assembly language. As a result, it would be relatively easy for Apple to implement QuickDraw on other processors, should some future device provide significantly better price/performance than the Am29000.

When an application program makes a QuickDraw call, the 680x0 processor on the system board stores the request in a queue. After several requests have been accumulated, they are sent in a burst to the GC card, which then executes them as a block. By grouping together lines of the same color and pattern, for example, the set-up overhead is reduced.

Apple's engineers considered a variety of approaches to accelerating QuickDraw. Graphics processors, such as TI's 340 series, provided good line drawing performance, but were not very fast for the setup code and other general-purpose functions required by QuickDraw. Apple also considered embedding QuickDraw in silicon, but rejected this approach as being too rigid.

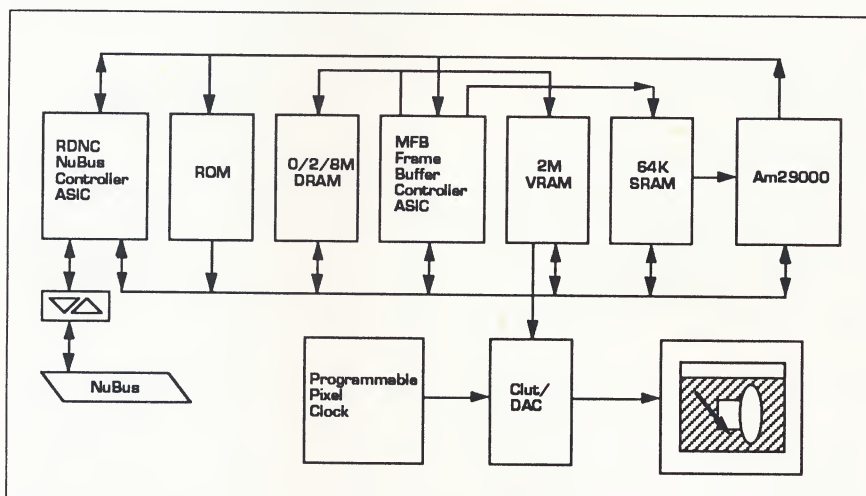
In fact, the Am29000-based design does not even include the QuickDraw code in ROM; the on-board ROM contains only a boot-loader, and the QuickDraw code is loaded from disk at power-up. Apple has dropped hints that the card may also be well suited to some future imaging model, which would require only that the code loaded from disk at boot time be changed. Font scaling, for example, which will be part of the System 7 software, will presumably be handled by the Am29000.

## Conclusions

The GC card is a natural approach to improving the performance of the Macintosh, especially for 24-bit color applications. Not only are drawing functions executed more quickly, but the 680x0 system processor is free to continue executing the application program while the graphics card is executing QuickDraw routines. The performance improvement is, of course, limited to the display functions, so it won't do much for compute-bound applications.

Dedicating a processor to display functions allows Apple to take advantage of multiple processors in a way that is transparent to applications programs. This approach also allows Apple to benefit from the price/performance of RISC microprocessors without requiring any

*Continued on page 6*



**Figure 1. Block diagram of the Apple 8•24 GC card.**



## **Xerox Imaging Systems introduces 29K-based OCR**

Xerox Imaging Systems (XIS) has announced the Kurzweil 5200, a leading-edge text recognition system that offers up to a 4-times performance improvement over prior products in the market. The K-5200 achieves this speed increase by using a proprietary intelligent character recognition (ICR) processing unit based on AMD's RISC technology.

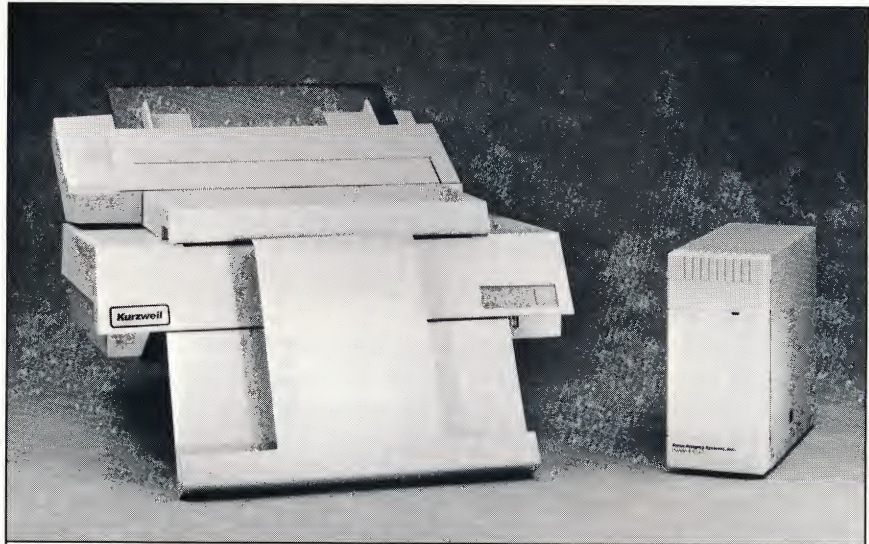
This Kurzweil system operates in an IBM PC-AT or 100 percent compatible PC, and comes complete with a scanner, proven Kurzweil character recognition software and the ICR processing unit. The K-series ICR software has been enhanced to read draft quality dot-matrix documents and provides improved table, column and bold recognition. The system's proprietary scanner features 400 dpi resolution, a bookedge for bound materials and 50 page automatic document feeder. The ICR processing unit includes AMD's Am29000

RISC processor and 6 Mb of RAM.

"RISC processing is the answer to the computational demands of text recognition," said Chip Maloney, vice president of marketing for Xerox Imaging Systems. "Fifteen years of research by Kurzweil in

artificial intelligence-based ICR, coupled with AMD's Am29000 32-bit microprocessor, have resulted in a high performance text recognition solution."

For more information, contact Xerox at 800-248-6550



**The K-5200 uses the Am29000 processor for fast execution of sophisticated text recognition software.**

## **Apple's 29K card speeds QuickDraw**

*Continued from page 5*

changes to application programs, so it is a much less painful approach than moving to a fully RISC-based Mac. A future high-end Macintosh might include the Am29000 graphics accelerator on the system board.

The GC card also highlights a key advantage of the Macintosh over IBM PCs. Because the Macintosh has a standard graphics library that is used by all applications, the GC will speed up all applications software without any special support from those applications. Windows and Presentation Manager should eventually provide a similar capability for IBM-compatible PCs, but, for the moment, accelerated display cards for PCs require many different software drivers, and even then do not accelerate all applications.

## **Bull uses Am29000 chips for dedicated controllers**

Bull, the French computer manufacturer, will use the Am29000 processor in a new controller design to be included in future generations of Bull computers. This announcement marks the first use of RISC by Bull in an embedded control application. Current developments include integrating the new 29K-based peripheral

interface systems into a wide range of Bull computer products which use the MULTIBUS II architecture.

"We chose the Am29000 processor for its processing power, which allows us to increase the performance of our new generation of products by an order of magnitude," said Gerard Breining, sales director at Bull. "The excellent price performance of this microprocessor allows us to offer our customers products at very competitive prices."



## Call the 29K Hotline at 800-2929-AMD to get your new product literature quickly

Several pieces of literature about the 29K Family are available. Please complete the Business Reply Card or call the 29K Family Hotline to request your selections today.

### Am29000 User's Manual

The Am29000 processor's technical features, programming information and complete instruction set descriptions are included in the Am29000 User's Manual. Any hardware or software engineer interested in evaluating or using the 29K Family should get this important reference manual.

### Fusion29K Catalog

More than 90 tools that speed your embedded product development are detailed in the third edition of the Fusion29K Catalog. It describes all software and hardware development tools available for the

### AMD presents the new vision of Apple graphics

This informative VHS-format video tape graphically explores the reasons Apple Computer selected the Am29000 processor to accelerate its QuickDraw routines. With your Visa or MasterCard handy, call the 29K Hotline and order "AMD Presents The New Vision Of Apple Graphics" for only \$9.95.

29K Family. This catalog includes products from over 40 expert suppliers of embedded development solutions.

Embedded and distributed solution chapters include:

- Laser printer and OCR solutions
  - Graphics solutions
  - Networking solutions
- Additional products include:
- Memory interface chips

- Software and hardware tools
- Real-time OS
- Board-level products
- Custom support

The Fusion29K program provides all the tools you need to get your product to market quickly.

### 29K Family Data Book

Complete 29K Family technical information is contained in this comprehensive data book, including complete datasheets for the:

- Am29000 microprocessor
- Am29027™ Arithmetic Accelerator
- HighC29K Cross Development Toolkit
- ASM29K Cross Assembler
- MON29K™ Target Resident Debug Monitor
- XRAY29K Source-Level Debugger.

In addition, the 29K Family Data Book includes many application notes that will shorten 29K designers' learning curves and hardware and software development time.



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## Upcoming Trade Show Information

AMD will be showing demonstrations of 29K-based applications and development tools at the following trade shows:

### Embedded Systems Conference

San Francisco Airport Hyatt, September 25-28, Booth 409. Tony Holbrook, AMD's Co-Chairman will be delivering the keynote address.

### Seybold Publishing Conference

San Jose Civic Exhibit Hall, October 3-5, Booth 5707. We will be demonstrating AMD's Laser29K printer controller, which provides 2 to 5 times the performance of the LaserWriter II NTX at similar costs. For a free exhibition pass to Seybold or for additional information, please contact the 29K Hotline at 800-292-9263



## Calling The Toll-Free 29K Hotline Is As Easy As 1 - 2 - 3

If you want technical assistance and the latest product information, call the toll-free 29K Hotline at 800-292-9263 from inside the US (512-462-5651 from elsewhere) and then:

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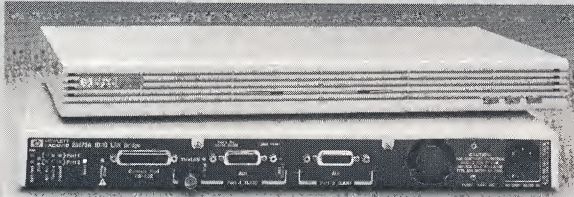
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- "2" ..... To reach the AMD 29K Support Engineering Staff.
- "3" ..... To request quick delivery of 29K literature, or to get on the Fusion29K News newsletter mailing list.

### **Hewlett-Packard Intros 29K-Based Network Bridges**

Hewlett-Packard has introduced two Am29000-based network bridges, the HP 10:10 LAN Bridge and the HP Remote Bridge that connect multiple local area networks into a single integrated communications system. The HP 10:10 LAN Bridge performs at Ethernet media speeds, filtering (64 byte packets) at the rate of 29,760 packets per second and forwarding 15,880 packets per second. Both HP bridges comply to the IEEE Spanning-Tree algorithm for support of back-up and redundant links.

The HP Remote Bridge connects two geographically dispersed LANs. This two-port remote bridge will connect Ethernet/ IEEE 802.3 LANs via T1 or 56 Kbs Digital Data Services public services.

"We evaluated 4 different processors' performance on our most time critical piece of networking software," said Dave Langley, Bridge Project Manager for Hewlett-Packard. "The 29K system outperformed all the other RISC and CISC chips we benchmarked. The feature that makes the 29K processor particularly appropriate for our bridge applications is the high bandwidth for data movement and instruction execution as a result of the separate instruction and data buses and burst mode memory



support. In addition, we needed to hit an under \$5,000 retail price goal, and the 29K processor and its interface to low-cost memories helped us meet this goal."

For further information, please contact Charles Breed, Product Marketing, at Hewlett-Packard at 916-785-5329.

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